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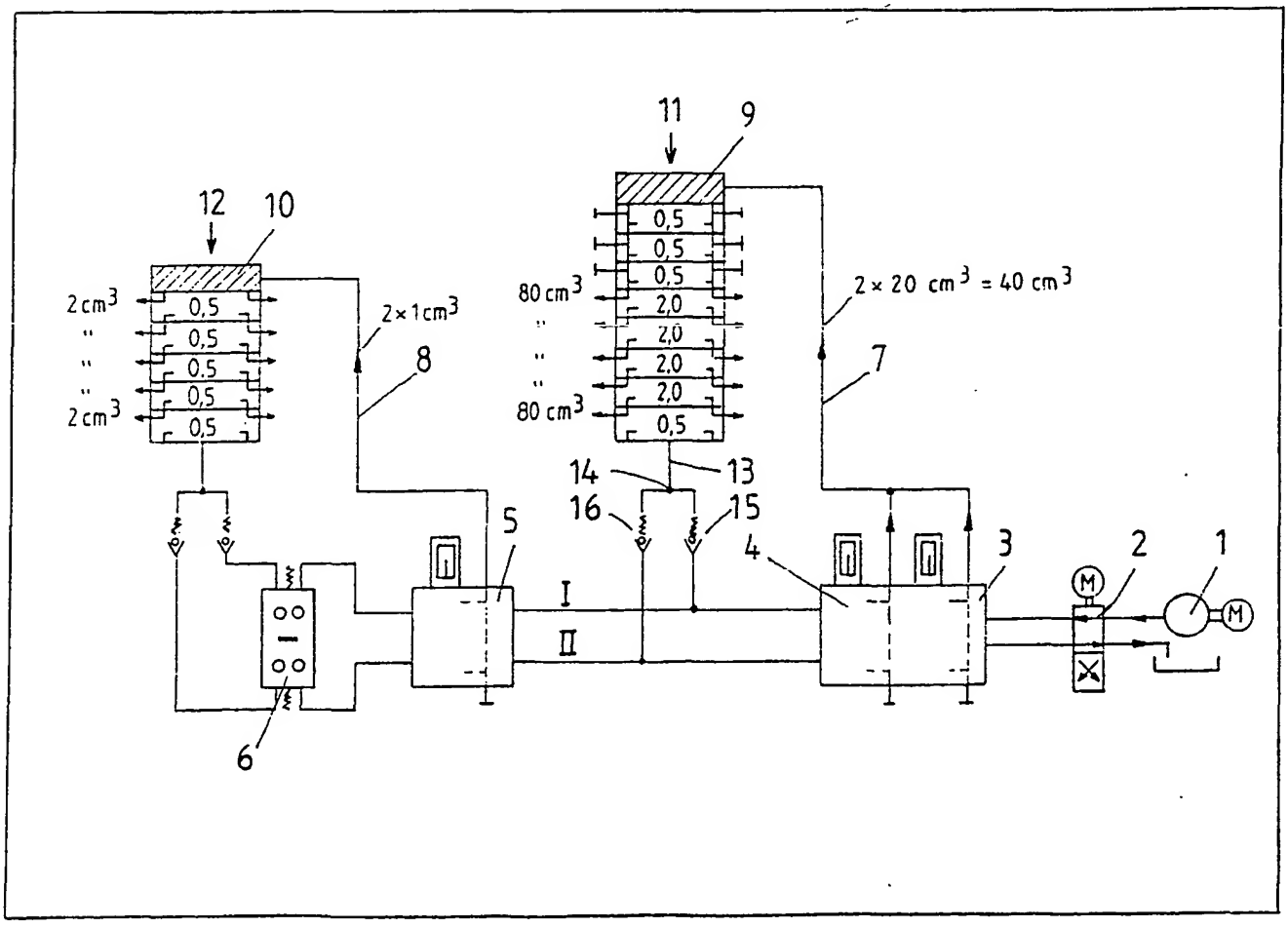
(54) **Lubrication systems**

(57) The lubrication system has two supply pipes (I and II) selectively supplied by a pump (1) through a reversing valve (2). At least one two-pipe lubricant distributor (3, 4, 5) is connected to the pipes, as well as at least one progressive distributor (11, 12). A pressure difference sensitive device (6) responds to a predetermined pressure difference existing between the pipes to actuate the reversing valve (2). Each two-pipe lubricant distributor (3, 4, 5) acts upon a change over of the reversing valve (2) to supply a predetermined quantity of lubricant to the control inlet of the progressive distributor (11, 12). The distributor (11, 12) is thereupon triggered to supply discrete quantities of lubricant from the supply lines (I and II) in turn to different ones of its outlets.

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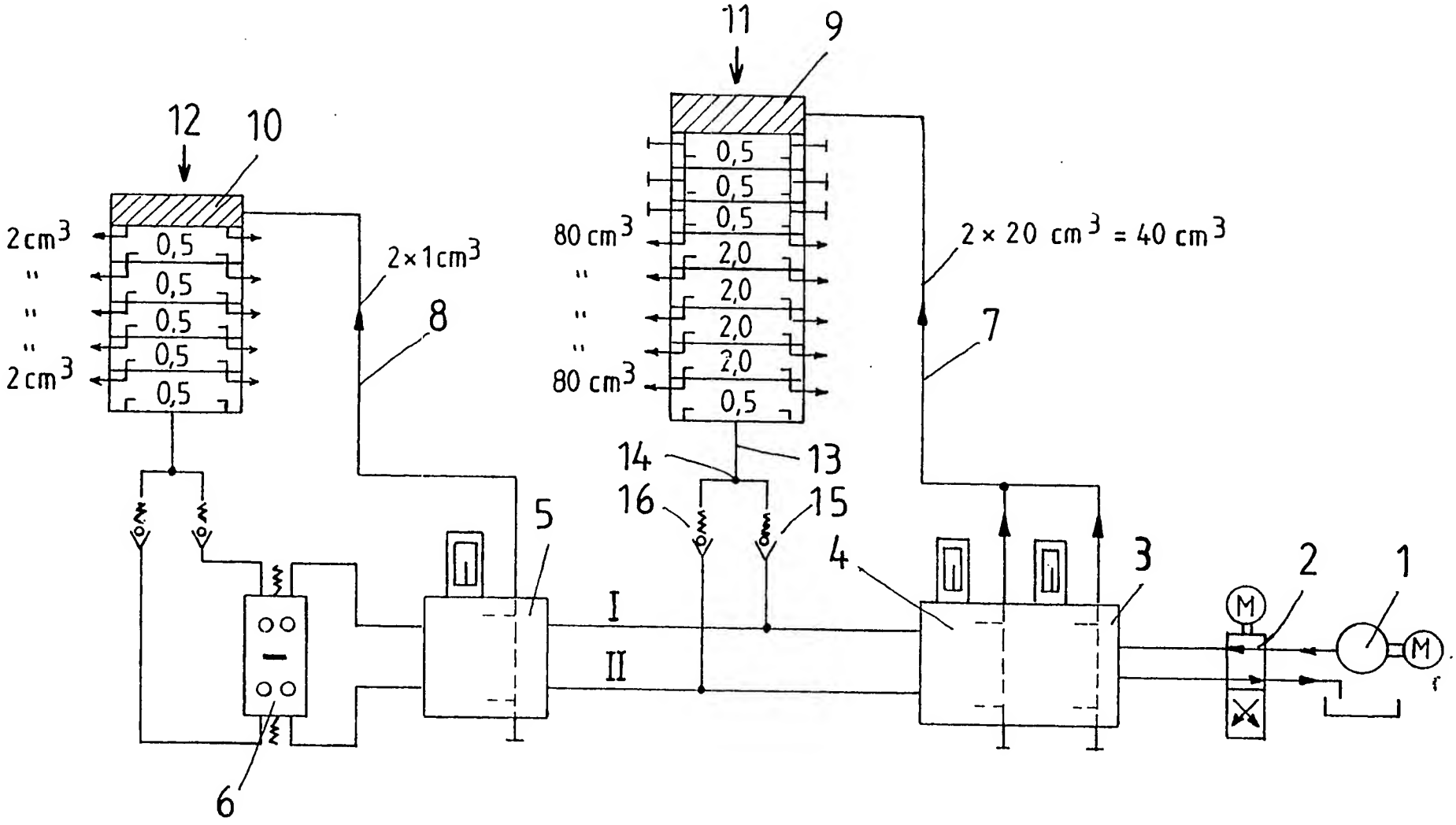
11
9
12
10
2 cm3
0,5
0,5
0,5
0,5
0,5
2 cm3
2×1cm3
8
80 cm3
0,5
0,5
0,5
2,0
2,0
2,0
2,0
0,5
80 cm3
2 × 20 cm3 = 40 cm3
7
14
13
16
15
5
4
3
2
1
I
II
6
M
M

SPECIFICATION

# Lubricating systems

The present invention relates to lubricating systems.

Lubricating systems are known for lubricating machines and machine plant with a large number of friction points and intermittent operation. The system is in principle very simple to manufacture, can be scaled down and scaled up and is therefore applicable readily to the most different types of machine as well as plants of heavy industry. Before the supply of the friction points distributors are incorporated, which are matched to the lubricating material requirements of different values and of which the delivery quantities are controllable to different values by adjustment screws. For the purpose the lubricant distributor for any two associated friction points include a dispensing piston and a control piston, as a result of which depending upon whether the supply pipe I or supply pipe II is under lubricant pressure, only at any given time is the associated friction point lubricated. A lubricating cycle comprises for this reason basically two lubricating rates.

In spite of these possible variations it becomes in practice important that an extremely large variation in lubricating oil needs for the individual friction points be provided by the system. Such variations cannot readily be achieved using two-pipe central lubricating equipment. Thus in a given equipment there may be, for example, friction points having individual lubricating cycles with different lubricant requirements; one point may need only one $cm^3$ of lubricant where another lubricant point may need 100 $cm^3$ of lubricant. Such conditions can be met with all known lubricating systems either not at all or only with very inefficient methods. The single pipe central lubricating equipments incorporating progressive distributors have been proposed but were found to be suitable only for smaller supplies and intermediate size machine plants requiring lubrication.

According to the invention, there is provided a lubrication system comprising two supply pipes each arranged to be supplied in turn with lubricant under pressure by a pump, a reversing valve arranged when actuated to effect the change over of the supply by the pump from one pipe to the other, sensing means for sensing the pressure difference of lubricant in the pipes and operable each time a predetermined pressure difference is exceeded to actuate the reversing valve, at least one two-pipe distributor coupled to the two pipes and arranged when supplied with lubricant under pressure to discharge a discrete quantity of lubricant from an outlet, and at least one progressive distributor coupled to the two supply pipes, the progressive distributor having a plurality of outlets each arranged to supply a lubricating point, and a control inlet connected to the two-pipe distributor to receive the lubricant discharged therefrom, the progressive distributor being responsive to receipt at its control input of a predetermined quantity of lubricant to effect a cycle in which a discrete quantity of lubricant is discharged from each outlet in turn.

According to the invention, there is provided a lubrication system comprising a pair of supply pipes, a pump, a valve arranged to switch the pump between the two pipes to supply each pipe in turn with lubricant under pressure, sensing means for sensing the pressure difference between the pipes at a location remote from the pump and operative where a predetermined pressure is sensed to cause the valve to switch the pump over from one pipe to the other, a first distributor coupled to the pipes and responsive to each pressure reversal resulting from the valve switching, to discharge a predetermined quantity of lubricant, and a progressive distributor having an inlet coupled to the pipes, a control inlet coupled to receive the lubricant discharged from the distributor and a plurality of outlets arranged to supply different lubrication points, the progressive distributor being response to receipt of lubricant at its control input to initiate a cycle in which it will supply each of its outlets in turn with a discrete quantity of lubricant from the pipes.

A lubrication system embodying the invention will now be described, by way of example, with reference to the accompanying diagrammatic drawing, the sole Figure of which shows a block diagram of the system.

As shown in the sole Figure, the system includes a pump 1, a two-way reversing valve 2, two supply pipes I and II, three two-pipe lubricant distributors 3, 4, 5 and a change-over device 6 at the end of the supply pipes I and II, to effect a reversal, that is a pressure reversal within the two supply pipes, in response to a predetermined pressure difference at the pipe ends.

The pump 1 is driven by an electric motor M to supply the necessary pressure and the corresponding lubricant quantity according to the requirements of the machine plant to be lubricated. After the pump motor is switched ON, the supply pipe I is supplied with lubricant under pressure to activate the two-pipe lubricant distributors 3, 4 and 5 as well as control pipes 7 and 8 which are respectively connected to control segments 9 and 10 of a corresponding progressive distributor 11 and 12.

The progressive distributor 11 is made up of a stack of nine individual segments, each of which, with the exception of the uppermost control pipe segment, houses a piston. This piston is subjected to pressure of lubricant alternately from its two opposite ends, to be displaced between two extreme positions. With the aid of inter-connecting passages between the segments linked by annular grooves in the pistons, the pistons are so controlled that they are displaced in a predetermined sequence; each piston upon displacement establishing the conditions to effect the displacement of the next piston in the sequence. All the piston bores in the seven lower segments are directly connected through an intermediate bore with a lubricant inlet to the

initial segment. A pipe 13 connects the inlet through a T-piece 14 and two non-return valves 15, 16 to the two supply pipes I, II to be alternately supplied with lubricant from these two pipes. The eighth segment does not communicate by means of the intermediate bore with the supply connection in the initial segment, that is the pipe 13, but does receive a supply of lubricant for the displacement of the piston from the immediately preceding segment. A further control of the piston in the initial segment, by the piston in the eighth segment, can be effected only by the supply lubricant through the control pipe 7 and the control pipe segment. The precise inner construction of the progressive distributor 11 and the progressive distributor 12 will be apparent from the disclosure in our British Patent Specification No. 1,295,603.

The connection of the progressive distributor 12 to one or other of the supply pipes I and II is effected by a change-over device 6, by which the formation of inoperative lubricant zones is avoided.

The two-pipe lubricant distributors 3 and 4 discharge discrete volumes of lubricant into the control pipe 7 for the progressive distributor 11. Each two-pipe lubricant distributor is thus employed, in order to make ready or provide an overall controlled quantity of 20 $cm^3$ of lubricant, the two lower outlets are closed and lubricant is instead guided through two inner circulation paths into the two upper outlets. The quantity of 20 $cm^3$ from each distributor 4 and 3 is taken by the progressive distributor 11 and supplied to the friction points, in which the received volume of the lowermost or initial segment is passed to the corresponding circulation cycle and is delivered therefrom to the supply pipe I thus supplying lubricant quantities through its successive outlets. The quantity of lubricant discharged from each outlet during each cycle are indicated in the drawing.

After the control quantity of 20 $cm^3$ has been received by the progressive distributor 11 from each distributor 3 and 4 and the distributor has delivered the lubricant to the corresponding outlets, the distribution cycle comes to an end. As a result the lubricant pressure in the supply pipe I builds up. The change-over device 6 responds to the detection of a predetermined pressure difference between the two pipes I and II to actuate the two-way change over valve 2. The described cycle is repeated by the supply pipe II so that a further 20 $cm^3$ quantity is supplied by each distributor 3 and 4 or as control quantity to the progressive distributor 11 making a total of 40 $cm^3$ of lubricant.

The second progressive distributor 12 operates in a similar manner to the first progressive distributor 11. However, only a delivery volume of 2 × 1 $cm^3$ is provided, so that the progressive distributor 12 per control cycle of the two-pipe central lubricating equipment makes only two circuits and per outlet 1 $cm^3$ is delivered.

It will be apparent that in the described system an extremely large difference in lubrication requirements for the individual friction points from 1 $cm^3$ on the one hand to 80 $cm^3$ on the other hand can be supplied during a single cycle. This system is substantially simpler and more practical in its construction than previously proposed systems.

Using the system hereinbefore described it is readily possible to satisfy during individual lubricating cycles supplies of lubricant to individual friction points in the ratio 1:100 exactly and in a simple manner.

The described system as previously proposed consists of a two-pipe central lubricating equipment extended by a progressive system which provides a progressive distributor integrated in parallel into the two-pipe system. A progressive distributor is thus used, which is fitted out in known manner with a control segment, which is supplied in such a manner that the piston of the starting segment is moved initially only when it is supplied from the control pipe, which is connected to the two-pipe lubricant distributor. The control segment is not in communication with the pressure connection in the initial segment of the progressive distributor but receives its supply of lubricant exclusively from the two pipe lubricant distributor. Hitherto, such a progressive distributor with a control segment has been proposed for use only in parallel circuits in a single pipe progressive system as is disclosed in our copending British Patent Specification No. 1,295,603.

For the simplification of the pressure connection of the two supply pipes at the progressive distributor it is proposed in a preferred construction of the invention, to provide the connection through a T-junction connecting piece and a respective non-return valve. Further it is preferable for the enlargement of the overall control quantity, to incorporate a plurality of two-pipe lubricant distributors in series and to connect the outlets thereof to control chambers of the progressive distributor.

The resulting lubricant system is capable of increased application in a simple manner by the connection of further two-pipe lubricant distributors with progressive distributors connected in parallel, as a result of which it is particularly advantageous to connect the pressure connection to the progressive distributors at the supply end through the change-over device, so that downstream of the change-over device a user can be connected, which requires a continuous lubricant monitoring.

## CLAIMS

1. A lubrication system comprising two supply pipes each arranged to be supplied in turn with lubricant under pressure by a pump, a reversing valve arranged when activated to effect the change over of the supply by the pump from one pipe to the other, sensing means for sensing the pressure difference of lubricant in the pipes and operable each time a predetermined pressure

difference is exceeded to activate the reversing valve, at least one two-pipe distributor coupled to the two pipes and arranged when supplied with lubricant under pressure to discharge a discrete quantity of lubricant from an outlet, and at least one progressive distributor coupled to the two supply pipes, the progressive distributor having a plurality of outlets each arranged to supply a lubricating point, and a control inlet connected to the two-pipe distributor to receive the lubricant discharged therefrom, the progressive distributor being responsive to receipt at its control input of a predetermined quantity of lubricant to effect a cycle in which a discrete quantity of lubricant is discharged from each outlet in turn.

2. A system according to claim 1, wherein the progressive distributor is coupled to the two supply pipes through a T-junction connection piece and corresponding non-return valves.

3. A system according to claim 1 or claim 2, wherein a plurality of two-pipe distributors are coupled to the two supply pipes and the outlets of at least two of the two-pipe distributors are connected to the same control inlet of the progressive distributor.

4. A system according to any one of claims 1 to 3, including a plurality of progressive distributors coupled to the two supply pipes.

5. A system according to claim 4, wherein the sensing means is located between the coupling points for the two last progressive distributors coupled to the two supply pipes at the downstream end portions.

6. A system according to any preceding claim, wherein the progressive distributor has a plurality of segments each constructed substantially as described in British Patent Specification No. 1,295,603.

7. A lubrication system comprising a pair of supply pipes, a pump, a valve arranged to switch the pump between the two pipes to supply each pipe in turn with lubricant under pressure, sensing means for sensing the pressure difference between the pipes at a location remote from the pump and operative when a predetermined pressure is sensed to cause the valve to switch the pump over from one pipe to the other, a first distributor coupled to the pipes and responsive to each pressure reversal resulting from the valve switching, to discharge a predetermined quantity of lubricant, and a progressive distributor having an inlet coupled to the pipes, a control inlet coupled to receive the lubricant discharged from the distributor and a plurality of outlets arranged to supply different lubrication points, the progressive distributor being responsive to receipt of lubricant at its control input to initiate a cycle in which it will supply each of its outlets in turn with a discrete quantity of lubricant from the pipes.

8. A lubricating system substantially as hereinbefore described, with reference to the accompanying drawing.

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